THE SAE 5000

INTRODUCTION

The SAE 5000 Impulse Noise Reduction System begins where other noise reduction systems leave off. It is the first and only system available to the audio market that can dramatically reduct the "clicks" and "pops" (impulse noise) present on records. Now many recordings that were considered unlistenable due to high levels of impulse noise can be played with the clarity and fidelity afforded by the dramatic reduction of these noise problems.

Furthermore, even new pressings can be played with the annoying "clicks" and "pops" that arise from grit, static discharge and imperfections on the record surface, reduced to a bare minimum.

The 5000 offers all of this without using the techniques of band-width or dynamic modification.

Before discussing the design and operations of the 5000, let us review the state of the phonograph record.

THE RECORD

The phonograph record, despite its shortcomings, has always offer-ed the consumer the highest level of playback quality in a home entertainment system. Unfortunately some of these shortcomings have been pretty severe:

1) Increased surface noise and deterioration of sound quality after repeated playings.

2) Susceptibility to damage through use and abuse.

3) A strong affinity for dirt, grit, etc.

Continous advances in technology have significantly reduced the effects of these failings. Improved stylus and tone arm design, and reduced tracking pressures have increased the life of the record. Developments in the areas of cueing systems and automatic changers have reduced the record's susceptibility to damage, and the development of quality record cleaning products has minimized dirt problems. However, the shortcomings have still remained and it is the end product that is the real concern and the real prob-lem. That end product is noise.

Noise appears in two formats: residual noise (hiss) and impulse noise (clicks and pops). Residual noise is generated through deterioration of the record surface (caused by extended playing and by heavy tracking pressure), bad pressing, grit, and if low grades of vinyl are used in the pressing, or high noise levels in the original master.

There have been several systems on the market which, to varying degrees, have been successful in the reduction of residual noise (through bandwidth modification, alteration of the dynamic range or a combination of both). However, these systems have negligible effects on impulse noise.

Impulse noise - more commonly known as "pops" and "clicks" - is generated by several phenomena. It may occur from record wear or mis-tracking, both of which can create gouges in the record surface. Also use and abuse inevitably generates grit and scratches. To further aggravate the problem, even brand new records can have pressing imperfections, not to mention static discharges which are inherit in any disc.

Despite advances in other areas, there has been no practical solution to removing this impulse noise from the playback of the modern record. No practical solution, that is until NOW -

The SAE 5000

Knowing that impulse noise can plague any record, that it is really the most annoying form of noise problem faced by the record user.

Knowing this the research began. The SAE 5000 is the result of this extensive research into and evaluation of impulse noise by its inventor, Jack Sacks.

It was known that impulse noise was audibly different from music, therefore it followed that there should be certain unique electrical properties that could be used to detect this noise during the playback process. As the development progressed, careful statistical analysis of impulse noise and music were made. Those properties which were unique to impulse noise, were isolated.

An electrical equivalence model was developed from this information. Several unique properties were pointed out. First, impulse noise has an extremely fast attack and decay time. Although there are several musical instruments which generate fast attack times, because of design they have much slower decay time. Second, impulse noise contains primarily out-of-phase information. Even in the most dramatic stereo passages this is not a common occurance. Utilizing this information a logic circuit was developed, which would continually monitor the program material for those parameters which described the presence of impulse noise.

This logic circuit and its associated algorithm (program set) are the heart of the 5000. Through careful evaluation of several parameters simultaneously, the logic circuit can detect the presence of impulse noise under even the most demanding musical conditions and keep to a minimum potential mistriggering.

Once the logic circuit detects the presence of impulse noise, the noise removal circuit is activated.

Since the impulse noise occurs during such a short period of time, the noise removal circuit actually shuts down the music during the impulse noise. To ensure program integrity a reconstruction circuit is also activated. Program material prior to and after the impulse noise is evaluated and extrapolated prior impulse information replaces the impulse noise that was removed. Through this approach, music continuity is maintained and impulse noise is removed without dynamic enhancement or bandwidth modification techniques. The entire process described requires less than <u>one thousandth of a second from deterioration to complete removal</u>!

NOTE: Although there are countless applications and uses for the 5000, there is one thing it will not do which should be made clear. The SAE 5000 is specifically designed to reduce impulse noise, and because of differences in characteristics, it will have negligible effects on residual noise. There are however several fine systems that are designed to handle those problems. In fact using the 5000 in conjunction with one of these can result in the most potent noise reduction combination available.

CONTROLS

The 5000, besides offering a tape monitor feature and system bypass, has two very important controls that are not only necessary for calibration but effective for demonstration.

1) INVERT - This switch converts the 5000 output from music without impulse to the removed impulse noise without the music. Normally used in adjusting the threshold control, it also offers a positive demonstration of the effectiveness of the 5000 system.

2) THRESHOLD CONTROL - As discussed previously, the logic circuit of the 5000 is constantly monitoring several parameters simultaneously. The weighting of these parameters is altered as the sensitivity control is adjusted from 0 (least sensitive) to 10 (most sevsitive).

Although the logic circuit will be effective over a wide range
of sensitivity settings, maximum benefits will be realized through
proper setting of this control.

BENEFITS

With the 5000 a new world awaits you. A world of great records
that were previously thought lost because of record damage, plus
records that are marred by static and record blemishes.

The 5000 is an important step in advancing the level of reality
attainable in home listening.

With all of these abilities the 5000 is designed and priced to be
an important component in any system. All of this and the quality
and performance that is truly SAE.

SPECIFICATIONS

T.H.D. (Total Harmonic Distortion) at any level to rated output from 20Hz to 20kHz	less than 0.1%
I.M. (Intermodulation Distortion) at any level of rated output with any 2 mixed frequencies between 20Hz to 20kHz at 4/1 Voltage Ratio	less than 0.1%
Signal-to-Noise Ratio	greater than 90 dB below rated output
Rated Output	2.50 Volts RMS
Frequency Response	$\pm$ 1dB 20 Hz to 20kHz
Output at Clipping	greater than 9 Volts into 10 K Ohms
Input Impedance	75 K Ohms
Output Source Impedance	500 Ohms
Output Lead Impedance	600 Ohms minimum
Insertion Loss	less than 1 dB
Power Consumption: 110-125 VAC, 50 Hz to 60 Hz	7 Watts
Shipping Weight	8 lbs.
Dimensions	10.75" W (27.3cm) x 3" H (7.6cm) x 9.25"D

Rack Mount Kit available